

Clever Counting

Unit Test Review

Name _____

Date _____ Period _____

To prepare for the Unit Test, use this review packet together with Probability Problem Set B.

1. Aunt Carol is buying an ice cream sundae. She has three choices of ice cream (vanilla, chocolate, strawberry), three choices of syrup (hot fudge, caramel or banana-goo) and a choice of two toppings (whipped cream or nuts). She can choose one from each category.
- a) Draw a counting tree or make an organized list that shows all of the possible combinations.
- b) How many days can Aunt Carol eat a sundae without eating the same combination twice?

$$3 \times 3 \times 2 = 18$$

- c) What is the probability that a sundae chosen at random will have caramel syrup?

$$3 \times 1 \times 2 = 6 \dots \text{so } 6 \text{ out of } 18 \text{ or } 1/3$$

or...

since caramel is just one out of three syrups, you could have just answered "1/3"

2. A certain state has license plates that follow a pattern of three letters followed by three digits. Repeats are allowed for both letters and digits.

a) How many different license plate combinations are possible?

$$26 \times 26 \times 26 \times 10 \times 10 \times 10 = 17,576,000$$

b) Assume that vowels are not used and repeats are not allowed for digits. How many different license plate combinations are possible?

$$21 \times 21 \times 21 \times 10 \times 9 \times 8 = 6,667,920$$

3. A combination lock has marks numbered 0-39. A lock sequence consists of three numbers. A number **cannot be repeated** in a combination.

a) How many lock combination sequences exist?

$$40 \times 39 \times 38 = 59,280$$

b) If you know that the first number is less than 5, and the second number is a two-digit number beginning with a “3”, how many possible combinations exist?

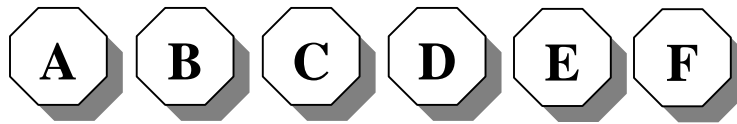
$$5 \times 10 \times 38 = 1,900$$

the 1st number must be 0,1,2,3 or 4 and the 2nd number must be 30-39; you've used two numbers, so now you have 38 choices for the last

4. There are four students in the after-school chess club. How many different ways can they line-up on the snack line?

$$4 \times 3 \times 2 \times 1 = 24$$

5.



A push button lock has six buttons labeled as above.

If REPEATS ARE allowed:

a) How many 6-character codes are possible? _____

$$6 \times 6 \times 6 \times 6 \times 6 \times 6 = 46,656$$

b) If the 3rd and 5th letters are vowels, how many different codes are possible? _____

$$6 \times 6 \times 2 \times 6 \times 2 \times 6 = 5,184$$

If REPEATS ARE NOT allowed:

c) How many 6-character codes are possible? _____

$$6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$$

d) If the 3rd and 5th letters are vowels, how many different codes are possible? _____

$$4 \times 3 \times 2 \times 2 \times 1 \times 1 = 48$$

6. The Pick-Grin-and-Win lottery game requires players to choose three numbers from 0 to 20. The order of the numbers matters, so 14-5-1 is different from 1-5-14. Numbers can be repeated.

a) What is the total possible number of different selections? _____

$$21 \times 21 \times 21 = 9,261$$

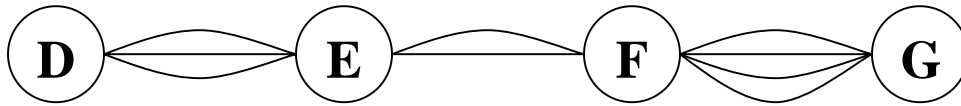
b) If the first number is a two-digit number, how many combinations exist? _____

$$11 \times 21 \times 21 = 4,851$$

c) If the first and last number is 3, how many combinations exist? _____

$$1 \times 21 \times 1 = 21$$

7.



a) How many nodes are in the network above?

4

b) How many edges are in the network above?

9

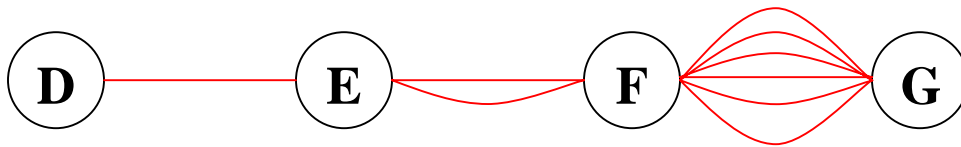
c) How many paths go from node D to node G ?

24

d) Using the same number of edges, design a network below that will have more paths than the network pictured above.



e) Using the same number of edges, design a network below that will have fewer paths than the network pictured above.

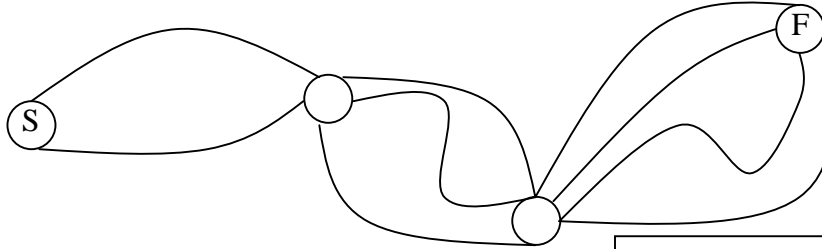


f) In general, if you are given a fixed number of nodes and edges, explain how you would design a network to MAXIMIZE the number of paths between the nodes.

Think about the surface area and volume problems with tall skinny boxes and cube-like boxes... you need to answer this one on your own!!

8. The network drawn below represents the possible routes between checkpoints for a forest ranger in a national park. The nodes are the checkpoint and the edges are the different trails that the ranger can walk.

How many different routes (paths) can the ranger take from start (S) to finish (F)?



$$2 \times 3 \times 4 = 24$$

9. How many **three-letter words** can be made with the letters L, M, N, P, Q, R, X, Y, and Z if repeats are allowed?

$$9 \times 9 \times 9 = 729$$

10. How many **three-letter words** can be made with the letters L, M, N, P, Q, R, X, Y, and Z if repeats are **NOT** allowed?

$$9 \times 8 \times 7 = 504$$

11. Jason and nine of his friends are playing a chess tournament. They decide that everyone will play each player one game. Jason says that since 10 players will play nine games each, a total of 90 games will be played, since $10 \times 9 = 90$. Is Jason right? If not, what is the correct number of games. Explain your reasoning.

45

you need to tell me why... solve a simpler problem (4 players instead of 10) and see if you can explain it!

12. In the English alphabet, there are five vowels are A, E, I, O, and U. The other 21 letters are called consonants. For the following questions, a word is any combination of letters, whether it is an actual dictionary word or not.

- a) How many 3-letter words can you make if the first and third letters must be consonants and the middle letter must be a vowel?

WHAT??!! You think I'm going to give you EVERY ANSWER??!! Spend some time on this one... phone a friend!!

- b) How many 3-letter *palindrome* words can you make if the first and third letters must be consonants and the second letter must be a vowel. A palindrome is a word that is spelled the same backwards and forwards, like MOM, DAD, or WOW.

- c) How many different 4-letter *palindrome* words can you make if the first and last letters are consonants and the second and third letters must be vowels?

- d) Are your answers to the previous two questions the same or different? Explain.

- e) How many 5-letter palindrome words can you create if the first three letters can be any letter, consonant or vowel, but no repeats are allowed in the first three letters?